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GB A 2029260
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GB 1538902
GB 0446107
GB 0319226

(58) Field of search
B1D

(54) Liquid filter

(57) A liquid filter comprises a roll of filter medium (1) having a central cavity (5a), and as the upstream layer of medium clogs it is progressively wound up on a wind-up reel (6) until only an auxiliary filter layer (F) is retained. In Figure 2 filtration flow is inwards, but in an alternative outward flow version the used filter medium is wound off the inside of the roll on to a reel (6) located in the central cavity. The filter medium may be a paper band or a thread which is wound like a reel of string.

Fig. 2

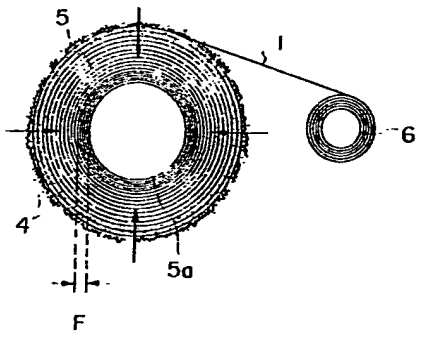

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Fig. 1A

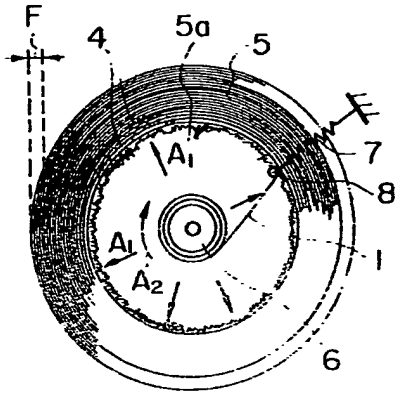

Fig. 1B

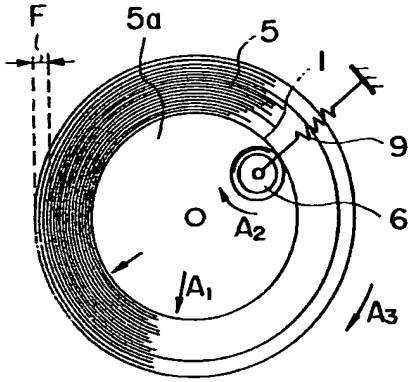

Fig. 2

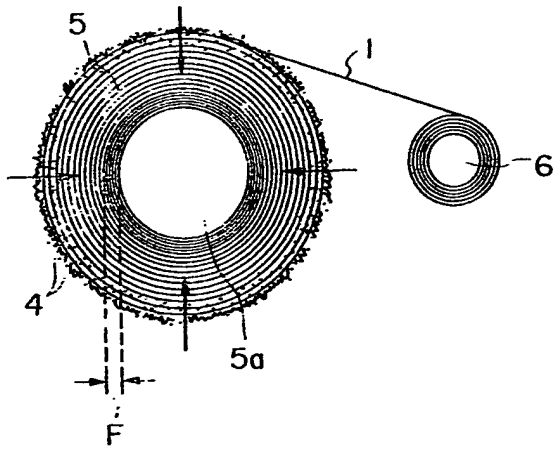

Fig. 3A

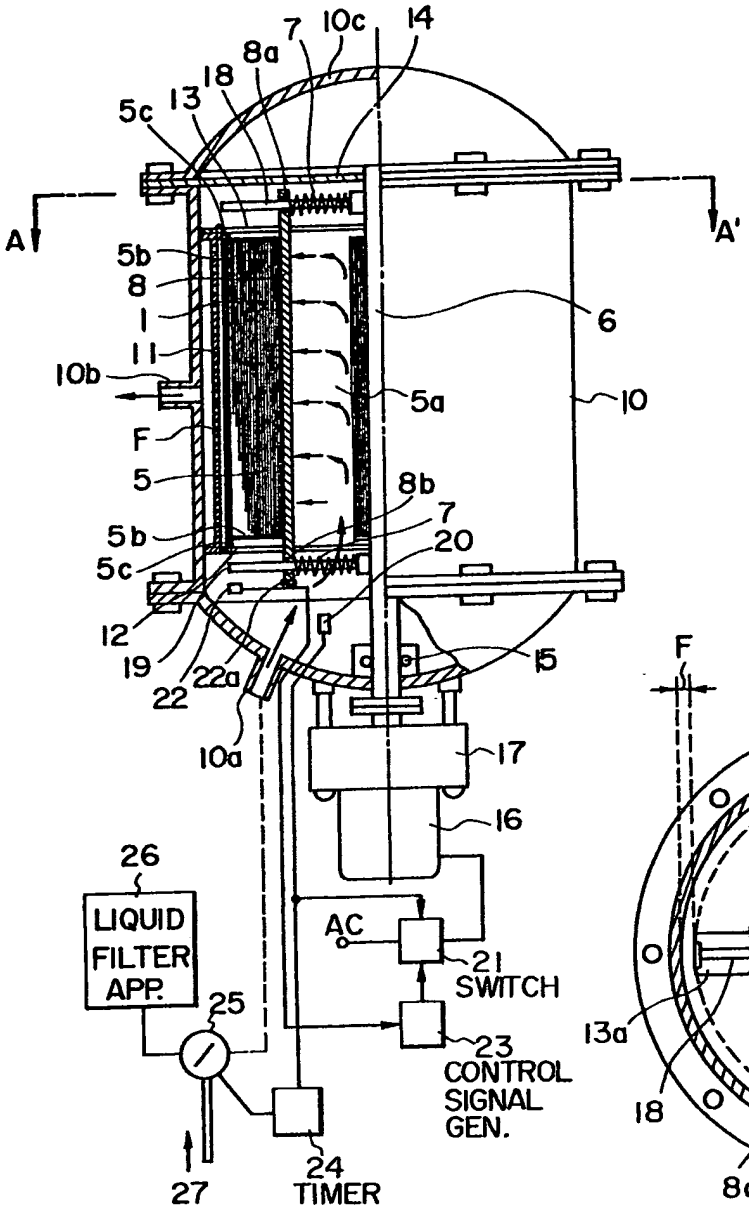
7
10c
14
8a
18
13
5c
A
A'
5b
8
1
11
10b
6
5a
10
F
5
8b
7
5b
20
5c
12
19
22
22a
10a
15
17
16
26
LIQUID FILTER APP.
AC
21
SWITCH
25
23
CONTROL SIGNAL GEN.
24
TIMER
27

Fig. 3B

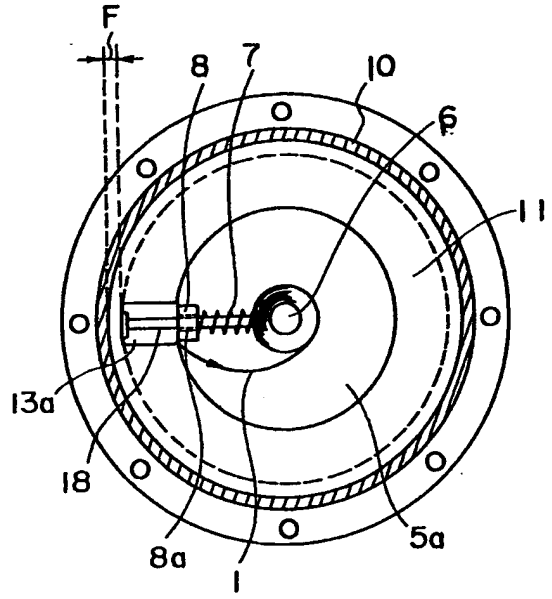
F
8
7
10
6
11
13a
18
8a
1
5a

Fig. 4

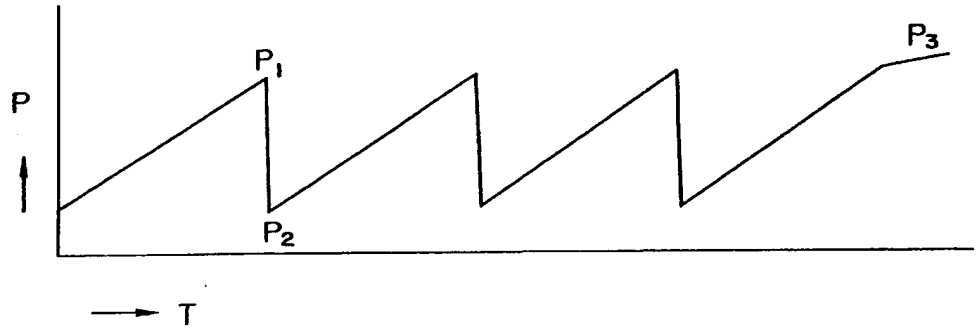

Fig. 5

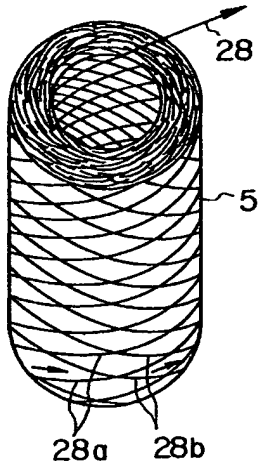

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Fig. 6

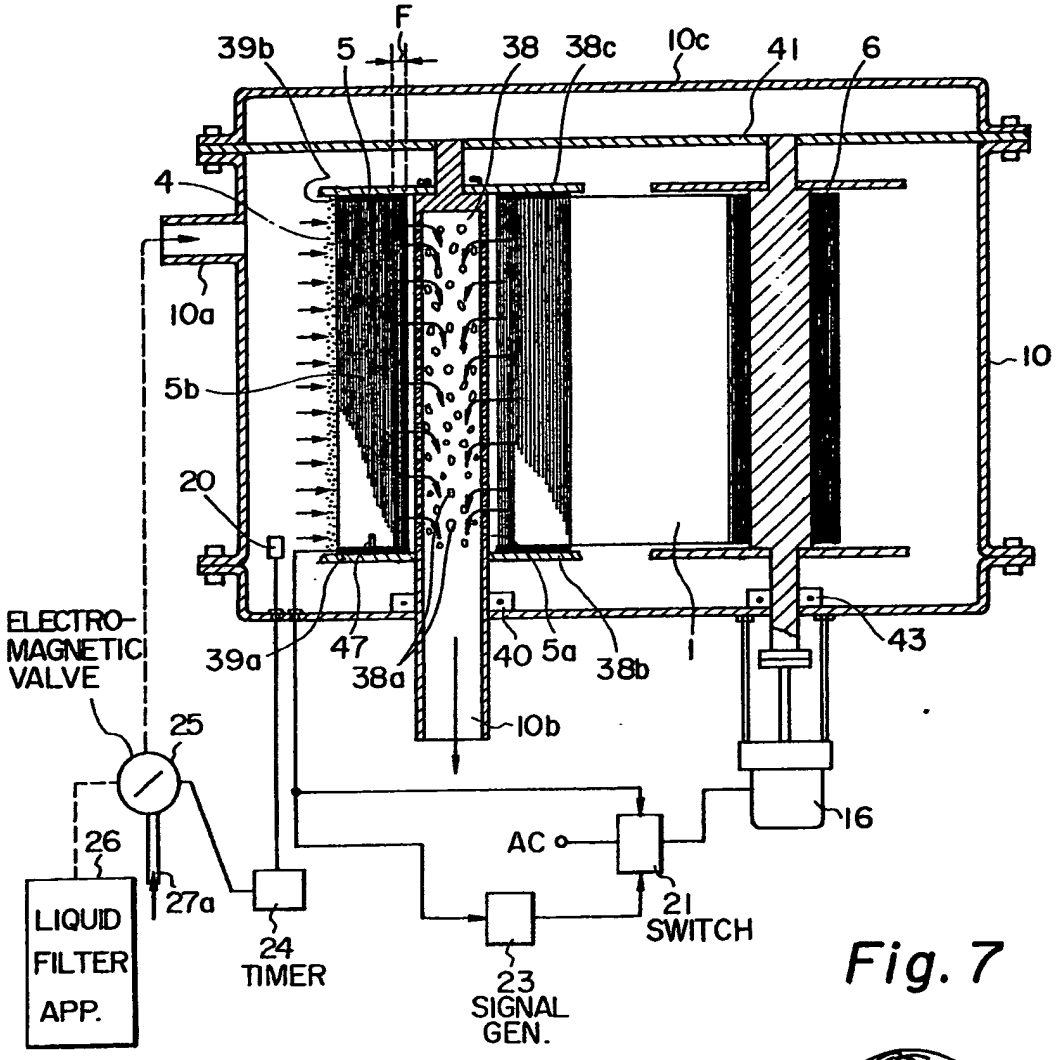
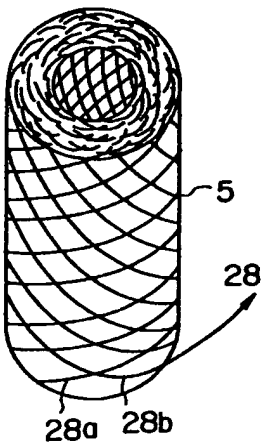


Fig. 7



SPECIFICATION

Liquid filter

The present invention relates to a small-size liquid filter which permits efficient and continuous removal of particles from liquid for a long period.

In the manufacture of semiconductor devices, such as LSI, a rod-shaped semiconductor blank is cut into a number of disc-shaped substrates and semiconductor element circuits are respectively formed in a number of rectangular small areas defined thereon, after which the substrates are each severed into individual semiconductor devices. The cutting operation takes place while sprinkling water on the part being cut. As a result of this, the water used for cutting contains large quantities of 0.3 to 1 μ diameter cutting chips of semiconductor materials and, in addition, the water cohtains noxious substance when the semiconductor substrates are made of materials such as gallium arsenide, the water contains noxious material. Therefore, the waste water cannot be drained directly.

A conventional solution to this problem is waste water treatment by a coagulative precipitation method, but this method has a defect of insufficient treatment. As a substitute for the abovesaid method, a method is now employed which uses a water-proof filter paper which is easy to handle and capable as a result of recent remarkable enhancement of its filtration performance, of removing fine particles less than 0.3 μ in diameter. This method employs what is called a cartridge system. In such a method, for example, a corrugated paper-like filter medium (hereinafter referred to as a filter paper) is supported in a circular form in a casing and water to be treated is supplied to the filter paper,.for example, from the outside thereof for filtration. In another such example a portion of a rolled filter paper is disposed so as to extend across a water passage, and when cutting chips are deposited on this extended portion, the filter paper is taken up on a roll for filtration.

These methods are easy to handle and excellent in filtering performance as compared with the coagulative precipitation method heretofore employed. With these methods, however, a lowering of the filtering efficiency caused by the small thickness of the filter paper used is unavoidable; namely, of almost all cutting chips captured on the paper surface, some of the chips smaller in diameter than pores of the filter paper are inevitably forced through the filter paper by water pressure, to drainage. Accordingly, the abovesaid methods have a common drawback that the intended filter performance cannot be achieved. In addition, according to the former method, i.e. the cartridge system, the filter paper is corrugated with a view to increasing the filtration volume, but the filtration volume obtainable is still small, necessitating frequent cartridge replacements. This not only hinders continuous long term filtration but also calls for cumbersome cartridge replacement operations, resulting in increased manufacturing costs for the semiconductor devices.

An object, of the present invention is to provide a small-sized.liquid filter which is free from the abovesaid defects of the prior art methods and capable of achieving continuous filtration for long periods while maintaining high filtration efficiency.

According to the present invention there is provided a liquid filter comprising:

a sealed container having an inlet for water to be filtered and an outlet for the water filtered; and

a filter medium located in the container so as to intersect a flow of water from the inlet to the outlet characterized in that the filter medium is rolled into a multilayer filter drum having a central cavity, and

a wind-up device is provided in the sealed container separately from the filter drum and on which an end of the filter medium is wound, an auxiliary filter being retained at the end of winding.

According to a further aspect of the present invention there is provided a liquid filter comprising:

a sealed container having an inlet for water to be filtered and an outlet for the water filtered; and

filter means located in the container so as to intersect a flow of water from the inlet to the outlet, wherein the filter, comprises a filter drum composed of a multilayer roll of filter medium and an adjacent, co-axial auxiliary filter, and

a wind-up device on which an end of the filter medium may be wound, is provided in the sealed container separate from the filter drum and on that side of the roll remote from the auxiliary filter.

An embodiment of the present invention is characterized by an arrangement in which a filter medium, rolled into a filter drum having a cavity formed centrally thereof, is wound up on a wind-up reel disposed in the cavity, an auxiliary filter layer being retained at the outside of the filter drum, water to be treated being supplied to the filter drum from the inner peripheral surface thereof for filtration.

In an alternative embodiment the wind-up reel is disposed outside the cavity. In this case, the auxiliary filter layer is retained at the inside of the filter drum, and water to be treated is supplied to the filter drum from the outer peripheral surface thereof, for filtration.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figs. IA, IB and *2* are plan views explanatory of the principles of the present invention;

Figs. 3A and *3B* are respectively a partly sectional front view illustrating an embodiment of the present invention and a section along a line A A' in the former;

Figure 4 is an operation process diagram;

Figure 5 is a perspective view illustrating another example of a filtering drum employed in the embodiment shown in Fig. 3A;

Figure 6 is a partly sectional front view illustra ting another embodiment of the present invention; and Fig. 7 is a perspective view illustrating another example of a filtering drum employed in the embodiment shown in Fig. 6.

A feature of an embodiment of the present invention resides in that the filter paper 1 is rolled

into a multilayer filter drum 5 with a cavity 5*a* formed centrally thereof, as shown in a plan view in Fig. IA or IB, and water to be treated is passed through the filter drum from the inner to the outer peripheral surface thereof, as indicated by the arrow AI, and at the same time, a wind-up reel 6, to which one end of the filter paper is fixed, is disposed in the cavity 5*a* of the filter drum 5. The inner diameter of the filter drum 5 and the outer diameter of the wind-up reel 6 are selected so that a space for admission of the water to be,treated, is always defined between the filter drum 5 and the wind-up reel 6 with filter paper 1 wound thereon to permit filtration of the water passing through the filter drum 5 from the inside to the outside thereof. Each time the water pressure increases due to the deposition of cutting chips 4 on the inner peripheral surface of the filter drum, the chips-bearing innermost layer of the filter paper 1 is wound on to the wind-up reel 6 layer by layer, so long as an auxiliary filter layer F remains.

In the example shown in Fig. IA, a rotary wind-up reel 6 is disposed at the centre of the cavity 5*a* of the fixed filter drum 5 and, in order to ensure the filter paper is wound tightly on the filter drum 5 during winding on to the wind-up reel 6, the filter paper is controlled by a pressure member 8 at the point at which it is taken off the drum 5. This member 8 is designed to apply the necessary pressing force by means of a spring member 7. In the example illustrated in Fig. IB, the wind-up reel 6 is urged by a spring member 9 against the inner peripheral surface of the filter drum 5 to rotate it, by which the filter paper 1 is wound up on to the wind-up reel 6 without loosening the winding of the filter paper on the filter drum 5, by utilizing the friction between the inner peripheral surface of the filter drum 5 and the wind-up reel 6.

During filtration using the filter drum 5 consisting of filter paper 1 wound in layers as proposed by the present invention, the chips 4 which pass through a first layer of the filter paper without being captured thereon are deposited on the surface of a second layer of the filter paper, and any chips 4 which still pass through the second layer are captured by a third layer. Thereafter, smaller chips 4 are deposited layer by layer in the same manner as mentioned above. Accordingly, by a suitable selection of the number of layers of the auxiliary filter layer F, it is possible to achieve filtration of waste water, substantially completely preventing an outflow of the cutting chips 4 to drainage. Thus the defects common to the above-mentioned conventional methods are overcome. Further, according to the present invention, since the filter paper is rolled into a multilayer filter drum, the total area of the filter paper can be markely increased by comparison with that of the cartridge system. This strikingly increases the continuous filtration time, and hence sharply decreases the time and operations necessary for the filter paper replacement. For instance, according to the cartridge system, when a filter paper 5 m in length and 0.5 m in width is rolled with an outer diameter of 0.5 m, the area of the filter paper is 2.5 m^2. By contrast thereto, when filter paper of the same size is rolled into 1000 layers with a mean diameter of 0.3 m, the total area is approximately 471 m^2, which is about 188 times larger than that in the cartridge system. Moreover, since the filter paper is generally 0.2 mm or so in thickness, the total thickness of the filter paper layers, even if rolled into 1000 layers, is 0.2 m. Accordingly, the outer diameter of the roll, which is the sum of the abovesaid mean diameter and this thickness, is substantially equal to the outer diameter in the cartridge system, and the filter drum can be housed in a container of substantially the same diameter. According to the embodiment illustrated in Figs. IA and IB, since the filter paper is wound up on a wind-up reel in the filter drum, the outer diameter of the filer drum is always constant, leading to the advantage that the filter can be formed small.

Figs. 3A and 3B are diagrams, partly in section, illustrating an embodiment of the present invention and its section along the line A-A' A sealed container 10 is shown having, a waste water inlet 10a, a clean water outlet 10b and a lid 10c, which is detachably fixed by bolts and nuts to permit filter drum replacements. The filter drum 5, consists of a roll of filter paper formed with, a central cavity 5*a*. An adhesive layer 5*b* is provided on each of the upper and lower end faces of the filter drum to such a thickness as not to hinder winding-up of the filter paper but so that water to be treated is admitted into the filter drum 5 only from its inner peripheral surface. A cylindrical punched metal plate 11 having a number of perforations, is watertightly fixed, by welding, at its upper and lower ends to the inner wall of the sealed container 10. An annular lower support plate 12 has its outer peripheral portion watertightly coupled to the lower end of the punched metal plate 11, and an annular upper support plate 13 is detachably screwed to the punched metal plate 11 in a watertight manner. The filter drum 5 having a water tight packing 5*c* jointed to the outer peripheral surface of each of the upper and lower ends is inserted into the punched metal plate 11, after which the upper support plate 13 is screwed to the upper marginal portion of the punched metal plate 11 to sandwich the filter drum 5 between the upper support plate 13 and the lower support plate 12, thereby supporting the filter drum 5 so that the water to be treated does not flow out to the purified water outlet from the gaps between the support plates 12 and 13 and the filter drum 5 via the punched metal. plate 11. The wind-up reel 6 and an upper bearing disc 14 are fixed together with the lid 10c. Reference numeral 15 signifies a lower watertight bearing, and the wind-up reel 6 is driven by a motor 16 via a reduction gear 17. Reference numeral 8 refers to the pressing piece and 18, 19 an upper support and a lower support for the pressing piece, which are respectively fixed to the upper portion and a lower portion of the winding-up reel 6. As shown in Fig. 3B, the pressing piece 8 is movably supported by the upper and lower supports 18 and 19 inserted in support holes 8*a* and 8*b* made in the upper and lower ends of the pressing piece 8. The

pressing piece 8 is biased by the spring member 7 to move outwardly, as the filter paper is wound up, in elongate holes 12*a* and 13*a* in the support plates 12 and 13 radially thereof, and it is always urged against the inner peripheral surface of the filter drum 5, defining the wind-up position of the filter paper 1 to prevent loosening within the roll of filter paper forming the filter drum 5. Moreover, waste water supplied from the inlet 10*a* is filtered by passing through the filter drum 5 from its inner peripheral surface to its outer peripheral surface, as indicated by the arrows, and the purified water is drained from the outlet 10b through the punched metal plate 11. A pressure sensor 20 detects a pressure increase at the waste water inlet, side of the filter drum 5 and, when the pressure reaches, for example, a value of 2 to 3 Kg/cm² as indicated by PI in an operation process diagram shown in Fig. 4, the pressure sensor 20 produces a signal to turn ON an electronic switch 21, thereby driving the motor 16 to wind-up the filter paper 1 on the wind-up reel 6. When that portion of the filter paper on which cutting chips 4 are deposited is thus wound up and the pressure returns to its initial value as indicated by P_2 in Fig. 4, the pressure sensor 20 stops the delivery of the signal to stop the winding of the filter paper 1 on the wind-up reel by the motor 16. Thereafter, the abovesaid operations are repeated upon each occurrence of the pressure rise, exposing the next layer of filter paper 1 for the deposition of cutting chips 4 thereon. A winding-up control switch 22 for example, a reed switch is provided and its lead wire is led out of the sealed container 10 in a watertight manner. Reference numeral 22*a* identifies its actuator and 23 a signal generator, which is mounted on the lower end of the pressing piece 8. When the thickness of the filter drum 5 reaches a certain value as a result of winding the filter paper 1 on the wind-up reel, the electronic switch 21 is turned OFF to inhibit further winding of the filter paper by the motor 16, making sure to leave the auxiliary filter paper layer F thick enough to inhibit the passage of the cutting chips 4 therethrough to the outlet side. Accordingly, if the filtration is continued, then more and more cutting chips 4 are deposited on the inner peripheral surface of the filter drum 5. Reference numeral 24 denotes a timer, 25 an electromagnetic change-over valve and 26 another liquid filter of the present invention. The timer 24 operates to produce its output when the pressure sensor 20 continuously detects, for a certain period of time, pressure at a point P_3 in Fig. 4, for example, a pressure exceeding 2 to 3 Kg/cm², in the state in which more and more cutting chips 4 are being deposited, as mentioned above. In consequence, the electromagnetic change-over valve 25 is switched to the route of the liquid filter 26, continuing filtration. Reference numeral 27 represents an inlet for waste water from a cutting device. Experiments have proved that the filter of this embodiment provides filtered water with a high degree of cleanness and permits long-time continuous running for waste water treatment.

For example, when waste water from a cutting device, containing about 30000 to 50000 cutting chips per 10 cc, was filtered at a flow rate of 25 liters/min, the number of chips contained in the filtered water was 100 to 300 per 10 cc, and the particle sizes of the drained particles were 0.3 to 1 μ. Further, the filtering performance hardly changed even after 500 hours' continuous running. Moreover, each semiconductor cutting device usually requires water (industrial or pure water) at a rate of 25 litres/min, and it is very common that 30 cutting devices installed per plant are held in full operation for 24 consecutive hours. Accordingly, the amount of water needed for each cutting device per 30 days is $25 \times 60 \times 24 \times 30 = 1080$ tons, that is, the amount of water consumed is as much as 1080×30 tons per month, and its cost is great. With the present invention, however, filtration is very efficient and does not employ any chemicals, and hence permits the re-use of the filtered water, affording a substantial saving of water.

While the present invention has been described in the foregoing as being applied to the filtering of waste water from cutting devices in the manufacture of semiconductor devices, it is a matter of course that the invention is also applicable to other waste water treatment such as, for example, in atomic-powered plants, and in this case, the filtering efficiency of the filter paper used is determined according to the particle size in waste water. Moreover, although in the foregoing embodiment winding of the filter paper on the wind-up reel is stopped to leave the auxiliary filter layer F on the drainage side, it is also possible to prepare the auxiliary filter layer F separately of the filter drum 5 and to assemble it with the filter drum 5 on the outside thereof so that the filter paper of the filter drum is supplied to the outermost layer thereof. This method dispenses with the devices for leaving the auxiliary filter layer F, such as the reed switch 23 and so forth, and hence permits simplification of the filter.

Although in the foregoing a paper-like filter medium is rolled into the filter drum, it is also possible that a thread, for example, a long thread of 3 to 8 mm in outer diameter, formed by bundling 2 μ to 20 μ fibers, is wound up into the filter drum 5 in such a manner that a thread 28*a* forming a layer and a thread 28*b* forming the next layer cross each other, as shown in a perspective view in Fig. 5, and the thread 28 is wound up on the wind-up reel 6 whenever cutting chips are deposited. In this case, the filtering function is performed by air gaps between adjacent threads and air gaps between fibres forming the thread. Accordingly, required filtration efficiency can be obtained by suitable selection of, the manner in which the thread, is wound, the thread spacing and the kind of thread used.

Another embodiment of the present invention will now be described. The feature of this embodiment resides in that the filter paper is rolled into a multilayer filter drum 5 with a cavity 5*a* formed centrally thereof, as shown in a plan view of Fig. 2, and water to be treated is passed through the filter drum from the outer peripheral surface thereof to the cavity 5*a*, as indicated by the arrows, and fur-

ther, a wind-up reel 6, to which one end of the filter paper 1 is fixed, is disposed outside of the filter drum 5. Each time the pressure of water, which passes through the filter drum, increases due to the deposition of cutting chips 4 on the outer peripheral surface of the filter drum as the filtration proceeds, the outermost layer of the filter paper on which the chips are disposed is wound up on the wind-up reel 6; in this case, however, an auxiliary filter layer F is not wound up on the wind-up reel 6. When filtering waste water by passing it through the filter drum 5 in the direction from its outer peripheral surface to its inner peripheral surface, even if some of the cutting chips 4 deposited on the outer peripheral surface pass through the first layer due to the water pressure, they will be captured by the next or second layer and, even if forced through further, they will ultimately be captured by a third, fourth or inner layer. Accordingly, by using the auxiliary filter layer F having such a number of layers as to inhibit the passage of smaller chips therethrough to the inner peripheral surface of the filter drum, and by taking up the filter paper upon each occurrence of a predetermined pressure rise caused by the deposition of the cutting chips 4, it is possible to substantially completely prevent the chips from flowing out to drainage. Thus, the defects common to the conventional methods are overcome. Further, by means of the present invention, the total area of the filter paper can be markedly increased in comparison with the conventional cartridge system. This strikingly lengthens the continuous filtration time, and hence sharply decreases the time and operations necessary for the filter replacement. For instance, according to the cartridge system, when a filter paper 5 m in length and 0.5 m in width is rolled with an outer diameter of 0.5 m, the area of the filter paper is 2.5 m^2 By contrast thereto, by means of the present invention, when the filter paper of the same size is rolled into 1000 layers with a mean diameter of 0.3 m, the total area is approximately 471 m^2, which is about 188 times larger than in the cartridge system.

Figure 6 is a partial cross-sectional view illustrating a.n embodiment of the present invention. In Fig. 6, reference numeral 10 indicates a container, 10*a* an inlet for water to be treated and 10*c* a cover, which is mounted by bolts and nuts on the container 10 in a manner to be detachable therefrom for the filter drum exchange. A rotary cylinder 38 is provided which is closed at its upper end but has a clean water outlet 10*b*. Reference numeral 38*a* indentifies a number of clean water discharge ports distributed over the entire area of the peripheral surface of the cylinder 38; 38*b* a disc-shaped lower support flange fixed to the outer peripheral surface of the cylinder 38 at the lower end portion thereof; and 38*c* an upper support flange detachably screwed to the rotary cylinder 38 at the top thereof. Reference numeral 5 denotes the filter drum, into which the filter paper 1 is rolled in layers to form the central cavity 5*a* having a diameter a little larger than the outer diameter of the rotary cylinder 38. A watertight packing 39*a* is placed on the lower support flange 38*b* and the rotary cylinder 38 is fitted into the cavity of the filter drum, after which another watertight packing 39*b* is placed on the filter drum and then the upper support flange 38*c* is fixed by means of screws to the rotary cylinder 38 so that water to be treated flows from the inner peripheral surface of the filter drum to the outer peripheral surface thereof. Reference numeral 40 represents a watertight bearing and 41 a bearing plate, which is fixed to the container 10 in a manner to be detachable therefrom together with the cover 10*c* and rotatably supports the rotary cylinder 38 at its upper and lower axle parts in cooperation with the watertight bearing 40. The water to be treated, which is supplied into the container 10 from the inlet 10*a* therefrom, passes through the filter drum 5 from the outer peripheral surface to the inner one thereof and flows through the discharge ports 38*a* of the rotary cylinder 38, thereafter being drained out from the outlet 10*b* the lower end thereof.

Reference numeral 6 indicates a wind-up reel, which is rotatably supported by the bearing plate 41 and a watertight bearing 43 provided at the lower end of the container. Reference numeral 16 designates a motor with a reduction gear, which is coupled with the end portion of a shaft projecting out of the container 10 to drive the wind-up reel 6, for winding the filter paper 1 from the outer periphery of the filter drum 5 thereon. The pressure sensor 20 detects the pressure in the container 10 at the portion where the water to be treated flows into the filter drum 5 and, for example, when the pressure reaches a value of 2 to 3 Kg/cm^2 at which the filtration cannot be continued, as indicated by P_1 in an operation process diagram shown in Fig. 4, the pressure sensor 20 produces a signal, by which the electronic switch 21 is turned ON to connect an AC power supply to the motor 16, thereby driving the wind up reel 6 to wind the filter paper 1 thereon. When the outermost layer of filter paper on which cutting chips 4 are deposited is wound up and, consequently, the pressure returns to its initial value, as indicated by P^2 in Fig. 4, the pressure sensor 20 stops the delivery of the signal, stopping the motor 16. Thereafter, upon each occurrence of the pressure rise, the abovesaid operations are repeated, exposing the next layer of the filter paper 1 for the deposition of cutting chips thereon. Reference humeral 47 denotes a thin watertight wind-up position control switch and 23 a signal generator. The switch 47 is disposed between a winding-up filter layers 5*b* and the auxiliary filter layer F of the filter drum 5. When the innermost one of the wind-up filter layers is wound up to expose the auxiliary filter layer F, the switch is turned OFF to send out a signal from the signal generator 23, by which the electronic switch 21 is controlled to cut off the AC power supply, preventing energization of the motor 16 to inhibit further wind-up of the filter paper even if the electronic switch 21 is turned ON by the pressure sensor 20 afterwards. Reference numeral 24 represents a timer and 26 another liquid filter apparatus of the present invention. The timer 24 operates to pro-

duce a signal when continuously detecting, for a certain period, that the pressure sensor 20 senses a pressure exceeding a value of 2 to 3 Kg/cm², as indicated by P_s in Fig. 4, in such a state that more and more cutting chips 4 are being deposited as a result of the abovesaid inhibition of further winding of the filter paper. Then an electromagnetic valve 25 is switched to the route of the liquid filter 26, continuing filtration. Reference numeral *27a* indicates an inlet for waste water from a cutting device. It has been proved that the equipment of the above-described arrangement provides filtered water with a high degree of cleanness and permits long term continuous running for waste water treatment.

A filtering apparatus could be fabricated by which, for example, when waste water from a cutting device, which contained about 30000 to 50000 cutting chips per 10 cc, was filtered at a flow rate of 25 liters/min, the number of chips contained in the filtered water was reduced down to 100 to 300 (0.3 to 1 μ in particle size) per 10 cc. Further, it has been proved that it is possible to produce equipment capable of continuous filtration over 500 hours and, at the same time, it has been found that the filtered water can be re-used for cutting since the filtered water has a high degree of cleanness and since no chemicals are employed in the treatment. Therefore, the present invention allows remarkable conservation of water for use with cutting devices which consumes large quantities of industrial and pure water.

While in the foregoing a filter paper is rolled into the filter drum 5, it is also possible that a long thread, for example, a long thread obtained by twisting 2 to 20 μ fibers into a thickness of 3 to 8 mm, be wound up into the filter drum 5 in such a manner that a thread *28a* forming a certain layer and a thread *28b* forming the next layer cross each other, as shown in a perspective view in Fig. 7, and the thread 28 is taken up layer by layer. It is also possible to prepare the auxiliary filter layer F separately from the filter drum 5. This method dispenses with the devices for leaving the auxiliary filter layer F. Moreover, although in the foregoing the present invention has been described as being applied to the filtering of waste water from cutting devices in the manufacture of semiconductor devices, the invention is applicable to various water treatments, such as for example, the treatment of waste water containing radioactive materials in atomic-powered plants. In this case, the filtering efficiency of the filter paper used is determined according to the sizes of particles contained in waste water.

As will be appreciated from the foregoing description, the present invention offers a small-sized liquid filter which permits continuous and efficient removal of particles from liquid over a long time, and hence, in practical use, is of great utility.

CLAIMS

1. A liquid filter comprising:

a sealed container having an inlet for water to be filtered and an outlet for the water filtered; and

a filter medium located in the container so as to intersect a flow of water from the inlet to the outlet characterized in that the filter medium is rolled into a multilayer filter drum having a central cavity, and

a wind-up device is provided in the sealed container separately from the filter drum and on which an end of the filter medium is wound, an auxiliary filter being retained at the end of winding.

2. A liquid filter comprising:

a sealed container having an inlet for water to be filtered and an outlet for the water filtered; and

filter means located in the container so as to intersect a flow of water from the inlet to the outlet, wherein the filter comprises a filter drum composed of a multilayer roll of filter medium and an adjacent, co-axial auxiliary filter, and

a wind-up device on which an end of the filter medium may be wound, is provided in the sealed container separate from the filter drum and on that side of the roll remote from the auxiliary filter.

3. A filter according to claim 2 wherein said auxiliary filter is integral with said roll.

4. A filter according to claim 2 wherein said auxiliary filter is separate from said roll.

5. A filter according to any of claims 1 to 4 in which the wind-up device is a reel which is provided in the cavity so that the flow of water is directed from the inside to the outside of the filter drum.

6. A filter according to any of claims 1 to 4 in which the wind-up device is a reel which is provided outside the filter drum so that the flow of water is directed from the outside to the inside of the filter drum.

7. A filter according to any preceding claim, in which the filter medium is a rolled filter paper.

8. A filter according to claims 1 to 6 in which the filter medium is a thread wound on a filter drum.

9. A liquid filter substantially as herein described with reference to any of Figures IA, IB and 2 with or without reference to any of Figures 3A to 7.

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